Postprint of Innovation and Practice of Xinhua News Agency' s Mobile Video Reporting

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Abstract

A mobile reporting system that addresses the full-process production requirements of mobile video reporting—including live transmission, ingest and acquisition, production sharing, and multi-channel distribution—offers advantages such as internet-based architecture, lightweight design, convenient deployment, and high collaborative efficiency. This represents an important innovation and successful practice built upon years of video engineering experience.

Full Text

Preamble

Title: Innovation and Practice in Xinhua News Agency' s Video Mobile Reporting

Abstract: This paper presents a mobile reporting system designed to meet the full production workflow needs of video mobile reporting, including live transmission, acquisition, production sharing, and multi-channel distribution. The system offers advantages such as internet-based architecture, lightweight design, convenient deployment, and high collaborative efficiency, representing a significant innovation and successful practice built upon years of video engineering experience.

Keywords: internet; lightweight; live streaming; acquisition; quick editing and sharing; multi-channel distribution

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The completion of Xinhua News Agency' s video high-definition (HD) project in March 2017 marked a significant turning point. The launch of the video HD system provided an excellent opportunity for the innovative development of our agency' s video mobile reporting. Based on the new platform system' s internet-based architecture, mobility, and convenience, combined with video mobile reporting requirements and the actual IT resource conditions at frontline news centers, we have implemented innovations and practices across the entire production workflow of video live transmission, acquisition, production sharing, and multi-channel distribution. This has established a new model for Xinhua' s video mobile reporting, providing safe and reliable technical support for video reporting in major campaigns such as the Belt and Road Initiative, BRICS Summit, Two Sessions, and National Day coverage.

1. Video Mobile Reporting Requirements

The year 2017 represented a crucial transition for Xinhua' s video reporting, shifting the frontline reporting model from single live broadcasting to a parallel approach combining live broadcasting and news release. This transformation significantly improved collaborative efficiency and news timeliness, but also required the technical support team to comprehensively transform: on the basis of comprehensive consideration of technical investment, production efficiency, and business operation security, while also accounting for equipment lightweighting and convenient deployment, to fully support frontline news center operations including video live broadcasting, signal transmission, program recording, video acquisition and distribution during major reporting events, as well as collaborative live broadcasting with rear studio centers.

Frontline mobile reporting must consider the complete workflow of video acquisition, storage, editing, and distribution. Video sources include SDI signals, IP streams, data files, and various other formats. Additionally, large-scale reporting events require consideration of multi-channel audio recording, monitoring, and usage.

2. Mobile Reporting System Construction

The mobile reporting system adopts a single-unit networking approach, typically equipped with 15 mobile non-linear editing workstations, 2 shared storage units, 1 live scheduling and switching system, 4 sets of codecs, 2 HD monitors, and 1 multi-screen display, collectively forming the frontline HD production system to provide acquisition, storage, production, and distribution functions. The video mobile reporting system is shown in Figure 1 [Figure 1: see original paper].

2.1 Video Live Streaming

Video live streaming serves as a crucial reporting method for Xinhua' s video mobile reporting, typically including on-the-move live reporting, breaking news

live reporting, and fixed multi-point live reporting for conferences. The key technical challenge in each video reporting assignment is how to transmit live video signals from the shooting location to the rear signal scheduling and distribution center in real-time, reliably, and securely.

For on-the-move live reporting, since shooting is not constrained by location or area and both the camera position and subject are constantly changing, it is impossible to fix transmission lines and equipment in one place. Live streaming backpacks are generally used to address video transmission during shooting. These backpacks feature multiple transmission methods (3G/4G/5G, microwave, satellite, WiFi, BGAN, and Ethernet), support H.264 and HEVC compression encoding, enable 4K 50/60P video transmission, and support up to 8-channel audio input. Their mobile and portable characteristics have made them one of Xinhua' s important technical choices for global mobile live reporting. Typically, a 1080p60 video signal can be transmitted with a compression bandwidth of just 800Kbps. In practical applications, the backpack also serves as a dedicated mobile network hotspot and mobile power supply, playing a crucial role when power or network failures occur at the reporting site, ensuring the normal operation of live broadcasting and news release services.

For breaking news reporting, traditional TV live reporting is often constrained by time and space, requiring large amounts of professional equipment, personnel, and lengthy preparation time. With the popularization of 4G and the advent of 5G, mobile phone live streaming, maritime satellite, and drone aerial photography have become the first choices for breaking news live reporting in the mobile internet era due to their portability. Currently, mobile apps have also achieved integrated use with drones and gimbal cameras, transmitting on-site live signals directly to the headquarters' backend signal receiving system through mobile networks to achieve cross-regional dissemination and real-time live broadcasting, meeting news dissemination requirements and improving news timeliness to show the audience on-site dynamics at the earliest possible time.

Fixed multi-point live streaming for conferences is primarily represented by the annual Two Sessions and Party Congress live reporting, where transmission channels are mostly bare fiber optics, requiring solutions for real-time monitoring of multiple video signals, signal switching, transmission, and recording. In practical work, there are also issues such as inconvenient deployment of single-channel optical transmission equipment, low reliability, and signal attenuation caused by excessively long video cables.

To address these problems, we tested the equalization capabilities of mainstream video optical transmission equipment and cables in the video field, conducted equipment selection based on actual test results, and independently designed an HD video field transmission system. This system integrates an HD switching matrix, multi-channel HD monitors, HD optical-electrical conversion modules, and HD recording equipment into an 8U shockproof protective case, simultaneously meeting the needs for switching, monitoring, transmission, and recording of 6-channel video signals, while ensuring the "safe" maximum usable length of

commonly used 100-meter Canare L-5CFB video cables in HD video transmission.

The live streaming system, as part of the HD video system, has built a backend live streaming technology system based on IP architecture for HD video signal acquisition, transmission, reception, scheduling, and distribution. This system achieves online scheduling and management of 100 channels of SD/HD multi-format video, providing live support for receiving and converging multi-type video signal sources including dedicated lines, fiber optics, backpacks, maritime satellites, and mobile phones, as well as format/standard conversion, scheduling, distribution, and management.

2.2 Signal Acquisition

At frontline news centers for video mobile reporting, there is typically a need for real-time acquisition and sharing of multiple video signals including self-shot footage, public signals, and clean PGM feeds returned from rear studios. This serves two purposes: first, to meet the quick editing needs of program production, allowing multiple video editors to rapidly access acquired video files; second, to store and backup precious video materials from major reporting events to ensure material integrity and facilitate future reference.

Signal acquisition typically includes the following functions:

2.2.1 Multi-type Signal Source Acquisition While Recording For different format signal sources, the live scheduling and switching system switches various types of live signals to corresponding IP or SDI formats, which are then connected to mobile non-linear editing workstations at the frontline video distribution center for real-time on-site acquisition to meet quick editing requirements. The acquisition system should support common post-production formats such as MPEG-2 I, MPEG-2 IBP, H.264, DV/DVCPRO/DVCPRO 50/DVCPRO HD, AVC-Intra, and XDCAM/XDCAM HD. During actual testing, we found that for small portable mobile non-linear editing workstations (CPU configuration: Intel Core i7-6700@3.40GHz), when acquiring video signals in H.264 format, CPU utilization rapidly surged to over 90% within minutes, and the acquired video files exhibited frame dropping. Therefore, in actual use, we typically choose to acquire files in MPEG-2 IBP 50Mbps 1080/50i MXF format.

2.2.2 Multi-format Recording Backup For real-time quick editing, video sources, acquisition formats, and production settings must be configurable according to program production needs. Considering the portability and ease of transportation and system setup for mobile reporting, we selected workstation-based solutions. For video material recording and backup, embedded acquisition devices are typically used, represented by products from Sony, AJA, Blackmagic, and other brands. These devices offer advantages including small size, low power consumption, operational portability, and good stability. They can meet the production needs of non-real-time video programs, allow presetting of formats

and segment durations before acquisition, and finally provide downloads via web interface.

The HD video field transmission system integration case is shown in Figure 2 [Figure 2: see original paper], and the multi-channel HD video recording file download interface is shown in Figure 3 [Figure 3: see original paper].

2.3 Production Sharing

To provide shared storage functionality after video acquisition, we adopted an HP micro tower storage server as the Windows primary shared storage server within the local area network, primarily used for writing acquired video signals, reading shared video files, and storing video files. The actual shared network environment is a Gigabit LAN, configured as RAID 1+0, with actual storage capacity of 8TB, capable of storing approximately 380 hours of 50Mbps HD video data files. Through actual storage read/write testing, when simultaneously handling 3-channel read/write operations, the total storage throughput bandwidth reaches a peak of around 785Mbps, meeting the video data sharing read/write requirements of the frontline reporting video distribution center.

During shared storage setup testing, we encountered slow file access to Windows Server 2012 shared directories from Windows 7 systems. This issue was resolved by disabling "Large Send Offload v2 (IPv4)" in the network adapter properties and disabling "Remote Differential Compression" in Windows Features.

The total storage throughput bandwidth is shown in Figure 4 [Figure 4: see original paper].

2.4 Multi-channel Distribution

For daily video program production, Xinhua' s video HD system serves as the support platform, operating on a 10 Gigabit IP network with high automation in video program production and distribution. For major reporting events, frontline news centers typically provide 100Mbps Internet access for video mobile reporting. Video production primarily relies on standalone non-linear editing workstations that mount local network storage via Windows sharing, then use standalone non-linear editing software to call video files from shared storage for editing, packaging, and finally outputting multi-format physical video files required for video distribution. A unified distribution system developed and operated based on Internet B/S mode provides technical support for video program production anytime and anywhere in an Internet environment. After acquisition, editing, and review, video manuscripts are finally distributed through the distribution system to multiple channels and terminals, releasing video programs to Xinhua' s video distribution website, client applications, overseas social media, archives, and other platforms.

3. Summary and Outlook

With the continuous development of Xinhua' s video business and technological evolution, the technical support and assurance model for video mobile reporting is also constantly progressing and innovating. Video mobile reporting has shifted from frontline news reporting primarily based on audio release to video live broadcasting, and now to parallel HD live broadcasting and news release, achieving multi-screen and multi-channel dissemination across platforms, lines, and networks including rear Chinese and English live broadcasting, Internet live feed distribution, CNC channel broadcasting, global live connections, and overseas media live broadcasting. Technically, video production standards have upgraded from SD to HD to 4K, video distribution has fully shifted from satellite-based to Internet-based production and release, and video live broadcasting has comprehensively covered satellite, dedicated lines, and Internet/mobile Internet along with network development. With the continuous development and deployment of 5G+cloud computing+AI technologies, news technology will undergo even greater changes, requiring us to continue tracking technology, focusing on business, and embracing the future.

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Note: Figure translations are in progress. See original paper for figures.